

CLAIMS

What is claimed is:

1 1. A method comprising:
2 determining a result based upon a network path of a received packet;
3 identifying, from a plurality of bins, at least one bin corresponding to the result, each of
4 the plurality of bins including a number of sets of fields; and
5 searching the at least one corresponding bin to identify a set of fields matching the
6 packet.

1 2. The method of claim 1, further comprising:
2 identifying an action associated with the set of matching fields; and
3 applying the action to the packet.

1 3. The method of claim 1, wherein the set of matching fields includes a
2 transport level field.

1 4. The method of claim 1, wherein determining the result comprises
2 identifying a single most specific filter matching the packet.

1 5. The method of claim 4, wherein the network path of the packet is
2 expressed as a source address and a destination address.

1 6. The method of claim 5, wherein identifying the single most specific
2 matching filter comprises:
3 performing a look-up in a first data structure to find an entry matching the source address
4 of the packet; and
5 performing a look-up in a second data structure to find an entry matching the destination
6 address of the packet.

1 7. A method comprising:
2 receiving a packet, the packet having a header including a source address, a destination
3 address, and a number of other fields;
4 identifying, from a number of entries in a data structure, an entry having a source address
5 prefix matching the source address of the packet, the matching entry including a
6 first identifier;
7 identifying, from a number of entries in another data structure, an entry having a
8 destination address prefix matching the destination address of the packet, the
9 matching entry including a second identifier;
10 identifying, from a number of bins, a bin corresponding to the first and second identifiers,
11 the corresponding bin including a number of sets of transport level fields; and
12 comparing at least one of the other fields of the packet header with each set of transport
13 level fields in the corresponding bin to find a matching set of transport level
14 fields.

1 8. The method of claim 7, further comprising applying to the received packet
2 an action associated with the matching set of transport level fields.

1 9. The method of claim 7, wherein the number of other fields in the packet
2 header includes at least one of a protocol, a source port, and a destination port.

1 10. The method of claim 9, wherein the source address of the packet header
2 comprises a source IP (Internet Protocol) address and the destination address of the
3 packet header comprises a destination IP address.

1 11. A method comprising:
2 receiving a packet, the packet having a header including a source address, a destination
3 address, and a number of transport level fields;
4 searching a source address data structure to find a first index and a third index, the first
5 index associated with a fully specified filter having a source prefix matching the
6 source address of the packet, the third index associated with a partially specified
7 filter having a source prefix matching the source address of the packet;
8 searching a destination address data structure to find a second index and a fourth index,
9 the second index associated with a fully specified filter having a destination prefix
10 matching the destination address of the packet, the fourth index associated with a
11 partially specified filter having a destination prefix matching the destination
12 address of the packet;
13 forming a key from the first and second indexes;
14 searching a primary table for an entry matching the key, the primary table including a
15 number of entries, each entry corresponding to one of a fully specified filter, a
16 fully specified filter intersection, and an indicator filter; and
17 if a matching entry is found in the primary table, accessing a list of bin pointers
18 associated with the matching entry, each bin pointer of the list identifying a bin
19 containing a number of sets of transport level fields.

1 12. The method of claim 11, further comprising:
2 accessing one of the bins identified by one of the bin pointers in the matching entry of the
3 primary table;
4 comparing the transport level fields of the packet with each set of transport level fields in
5 the accessed bin; and
6 if the accessed bin has a set of transport level fields matching the transport level fields of
7 the packet, applying an action associated with the matching set of transport level
8 fields to the received packet.

1 13. The method of claim 11, further comprising:
2 searching a first of two secondary tables for an entry matching the third index, the first
3 secondary table including a number of entries, each entry corresponding to a
4 partially specified filter;
5 searching a second of the two secondary tables for an entry matching the fourth index, the
6 second secondary table including a number of entries, each entry corresponding to
7 a partially specified filter; and
8 if no match is found in the primary table and a matching entry is found in one of the two
9 secondary tables, accessing a list of bin pointers associated with the matching
10 entry, each bin pointer of the list identifying a bin containing a number of sets of
11 transport level fields.

1 14. The method of claim 13, further comprising:
2 accessing one of the bins identified by one of the bin pointers in the matching entry of the
3 one secondary table;
4 comparing the transport level fields of the packet with each set of transport level fields in
5 the accessed bin; and
6 if the accessed bin has a set of transport level fields matching the transport level fields of
7 the packet, applying an action associated with the matching set of transport level
8 fields to the received packet.

1 15. The method of claim 13, further comprising:
2 if no match is found in either of the secondary tables, accessing a list of bin pointers
3 associated with a default entry, each bin pointer of the list identifying a bin
4 containing a number of sets of transport level fields.

1 16. The method of claim 15, wherein the default entry corresponds to an entire
2 two-dimensional address space.

1 17. The method of claim 11, further comprising
2 searching the source address data structure to find a fifth index associated with a wide
3 filter having a source prefix matching the source address of the packet;
4 searching the destination address data structure to find a sixth index associated with a
5 wide filter having a destination prefix matching the destination address of the
6 packet;
7 forming a second key from the fifth and sixth indexes;
8 searching a wide filter table for an entry matching the second key, the wide filter table
9 including a number of entries, each entry corresponding to a wide filter; and
10 if no match is found in the primary table and a matching entry is found in the wide filter
11 table, accessing a list of bin pointers associated with the matching entry in the
12 wide filter table, each bin pointer of the list identifying a bin containing a number
13 of sets of transport level fields.

1 18. The method of claim 17, further comprising:
2 accessing one of the bins identified by one of the bin pointers in the matching entry of the
3 wide filter table;
4 comparing the transport level fields of the packet with each set of transport level fields in
5 the accessed bin; and
6 if the accessed bin has a set of transport level fields matching the transport level fields of
7 the packet, applying an action associated with the matching set of transport level
8 fields to the received packet.

1 19. The method of claim 17, wherein each wide filter contained in the wide
2 filter table comprises a fully specified filter having a number of indicator filters
3 exceeding a specified threshold.

1 20. The method of claim 11, wherein the number of transport level fields in
2 the received packet comprises at least one of a source port, a destination port, and a
3 protocol.

1 21. A method comprising:
2 grouping a plurality of rules of a packet classification database into a number of rule sets,
3 each rule set including rules having a source and destination address pair, each
4 rule set associated with a filter corresponding to the source and destination
5 address pair;
6 associating a small bin with each of the filters, each small bin including a group of a
7 number of sets of transport level fields, each set of transport level fields in the
8 group associated with one of the rules in the associated rule set.

1 22. The method of claim 21, wherein at least two of the filters are associated
2 with a same small bin.

1 23. The method of claim 21, further comprising identifying a number of filter
2 intersections, each filter intersection corresponding to an intersection of at least two of
3 the filters.

1 24. The method of claim 23, further comprising associating a large bin with
2 each of the filter intersections, the large bin of each filter intersection comprising a union
3 of the small bins associated with each of the at least two filters of the intersection.

1 25. The method of claim 24, further comprising identifying a number of
2 indicator filters, each indicator filter formed from a source address of one of the filters
3 and the destination address of another of the filters.

1 26. The method of claim 25, wherein the filters associated with the
2 classification database includes fully specified filters, partially specified filters extending
3 an entire source address space, and partially specified filter extending an entire
4 destination address space.

1 27. The method of claim 26, further comprising:
2 creating a primary table including a number of entries, each entry of the primary table
3 associated with one of the fully specified filters, one of the filter intersections, or
4 one of the indicator filters, each entry of the primary table including a key and at
5 least one pointer to the small bin associated with the corresponding filter of that
6 entry;
7 creating a first secondary table including a number of entries, each entry of the first
8 secondary table associated with one of the partially specified filters having a
9 source address extending the entire source address space, each entry of the first
10 secondary table including a key and a pointer to the small bin associated with the
11 corresponding filter of that entry; and
12 creating a second secondary table including a number of entries, each entry of the second
13 secondary table associated with one of the partially specified filters having a
14 destination address extending the entire destination address space, each entry of
15 the second secondary table including a key and a pointer to the small bin
16 associated with the corresponding filter of that entry.

1 28. The method of claim 27, wherein the at least one pointer in one entry of
2 the primary table identifies a large bin associated with a corresponding filter intersection
3 of that entry.

1 29. The method of claim 27, wherein the primary table includes a subset of
2 the number of indicator filters.

1 30. The method of claim 27, wherein the filters associated with the
2 classification database further includes wide filters.

1 31. The method of claim 30, further comprising creating a wide filter table
2 including a number of entries, each entry of the wide filter table associated with one of
3 the wide filters, each entry of the wide filter table including a key and a pointer to the
4 small bin associated with the corresponding filter of that entry.

1 32. The method of claim 21, further comprising:
2 creating a source address data structure, the source address data structure including a
3 number of entries, each of the entries including a source prefix corresponding to
4 one of the filters; and
5 creating a destination address data structure, the destination address data structure
6 including a number of entries, each of the entries including a destination prefix
7 corresponding to one of the filters.

1 33. A data structure comprising:
2 a plurality of filters, each filter including a source address prefix and a destination
3 address prefix; and
4 a plurality of bins, each bin comprising a number of triplets, each triplet including at least
5 one transport level field, an action, and a priority;
6 wherein each of the plurality of filters is associated with at least one of the bins.

1 34. The data structure of claim 33, wherein one of the bins is associated with
2 at least two of the filters.

1 35. The data structure of claim 33, wherein the source address prefix
2 comprises a source IP (Internet Protocol) address prefix and the destination address prefix
3 comprises a destination IP address prefix.

1 36. The data structure of claim 33, wherein the at least one transport level
2 field comprises one of a protocol, a source port, and a destination port.

1 37. The data structure of claim 33, wherein each of at least some of the bins
2 comprises a small bin.

1 38. The data structure of claim 37, wherein at least one of the bins comprises a
2 large bin, the large bin comprising a union of the small bins associated with a filter
3 intersection.

1 39. A data structure comprising:
2 a source address data structure, the source address data structure including a number of
3 entries, each of the entries having a source prefix, a filter type, and an index;
4 a destination address data structure, the destination address data structure including a
5 number of entries, each of the entries having a destination prefix, a filter type, and
6 an index;
7 a primary table, the primary table including a number of entries, each of the entries
8 having a key and at least one bin pointer, wherein each of the entries is associated
9 with one of a fully specified filter, a fully specified filter intersection, and an
10 indicator filter; and
11 two secondary tables, each of the secondary tables including a number of entries, each of
12 the entries having a key and at least one bin pointer, wherein each entry of each of
13 the two secondary tables is associated with a partially specified filter.

1 40. The data structure of claim 39, wherein one of the secondary tables is
2 associated with partially specified filters having a source address expanding an entire
3 source address space, and the other of the two secondary tables is associated with
4 partially specified filters having a destination address expanding an entire destination
5 address space.

1 41. The data structure of claim 39, wherein the filter type in each of the source
2 address and destination address look-up tables indicates one of a fully specified filter and
3 a partially specified filter.

1 42. The data structure of claim 39, further comprising a wide filter table, the
2 wide filter table including a number of entries, each of the entries having a key and at
3 least one bin pointer, wherein each entry of the wide filter table is associated with a wide
4 filter.

1 43. The data structure of claim 42, wherein the filter type in each of the source
2 address and destination address look-up tables indicates one of a fully specified filter, a
3 partially specified filter, and a wide filter.

1 44. The data structure of claim 39, wherein each of the bin pointers in the
2 entries of the primary and secondary tables identifies one of a plurality of bins of a
3 second data structure, each bin including a number of triplets, each triplet having at least
4 one transport level field, an action, and a priority

1 45. The data structure of claim 44, wherein each source address prefix in the
2 source address data structure comprises a source IP (Internet Protocol) address prefix and
3 each destination address prefix in the destination address data structure comprises a
4 destination IP address prefix.

1 46. The data structure of claim 45, wherein the at least one transport level
2 field comprises one of a protocol, a source port, and a destination port.

1 47. The data structure of claim 39, wherein the primary table includes entries
2 for a subset of all possible indicator filters.

1 48. An apparatus comprising:
2 a processing device;
3 a memory coupled with the processing device, the memory having a first data structure
4 stored therein, the first data structure including
5 a source address look-up data structure, the source address look-up data
6 structure including a number of entries, each of the entries having a
7 source prefix, a filter type, and an index,
8 a destination address look-up data structure, the destination address look-
9 up data structure including a number of entries, each of the entries
10 having a destination prefix, a filter type, and an index,
11 a primary table, the primary table including a number of entries, each of
12 the entries having a key and at least one bin pointer, wherein each
13 of the entries is associated with one of a fully specified filter, a
14 fully specified filter intersection, and an indicator filter, and
15 two secondary tables, each of the secondary tables including a number of
16 entries, each of the entries having a key and at least one bin
17 pointer, wherein each entry of each of the two secondary tables is
18 associated with a partially specified filter.

1 49. The apparatus of claim 48, further comprising:
2 a second memory coupled with the processing device, the second memory having a
3 second data structure stored therein, the second data structure including a plurality
4 of small bins, each small bin including a number of triplets, each triplet having at
5 least one transport level field, an action, and a priority;
6 wherein each of the bin pointers in the entries of the primary and secondary tables
7 identifies one of the small bins of the second data structure.

1 50. The apparatus of claim 49, wherein the second memory comprises a
2 content addressable memory.

1 51. The apparatus of claim 49, wherein the at least one transport level field
2 comprises one of a protocol, a source port, and a destination port.

1 52. The apparatus of claim 51, wherein the second data structure stored in the
2 second memory includes at least one large bin, the large bin comprising a union of small
3 bins associated with a filter intersection.

1 53. The apparatus of claim 48, wherein the memory comprises at least one of
2 a SRAM, DRAM, SDRAM, and a DDRDRAM.

1 54. The apparatus of claim 48, wherein the memory comprises part of the
2 processing device.

1 55. The apparatus of claim 48, wherein one of the secondary tables is
2 associated with partially specified filters having a source address expanding an entire
3 source address space, and the other of the two secondary tables is associated with
4 partially specified filters having a destination address expanding an entire destination
5 address space.

1 56. The apparatus of claim 48, wherein the filter type in each of the source
2 address and destination address look-up tables comprises one of a fully specified filter
3 and a partially specified filter.

1 57. The apparatus of claim 48, wherein the first data structure further
2 comprises a wide filter table, the wide filter table including a number of entries, each of
3 the entries having a key and at least one bin pointer, wherein each entry of the wide filter
4 table is associated with one of a wide filter and an indicator filter.

1 58. The apparatus of claim 57, wherein the filter type in each of the source
2 address and destination address look-up data structures comprises one of a fully specified
3 filter, a partially specified filter, and a wide filter.

1 59. The apparatus of claim 48, wherein each source address prefix in the
2 source address look-up data structure comprises a source IP (Internet Protocol) address
3 prefix and each destination address prefix in the destination address look-up data
4 structure comprises a destination IP address prefix.

1 60. The apparatus of claim 48, wherein the primary table includes entries for a
2 subset of all possible indicator filters.

1 61. An apparatus comprising:
2 a content addressable memory (CAM), the CAM having stored therein a plurality of bins,
3 each of the bins including a number of sets of fields; and
4 a processing device coupled with CAM, the processing device capable of determining a
5 result based upon the network path of the packet and identify, from the plurality
6 of bins, at least one bin corresponding to the result, the CAM to search the at least
7 one corresponding bin to identify a set of fields matching the packet.

1 62. The apparatus of claim 61, wherein the CAM returns an action associated
2 with the set of matching fields, the processing device capable of executing the action.

1 63. The apparatus of claim 61, wherein the matching set of fields includes a
2 transport level field.

1 64. The apparatus of claim 61, wherein the processing device, when
2 determining the result, identifies a single most specific filter matching the packet.

1 65. An article of manufacture comprising:
2 a machine accessible medium providing content that, when accessed by a machine,
3 causes the machine to
4 determine a result based upon a network path of a received packet;
5 identify, from a plurality of bins, at least one bin corresponding to the result, each
6 of the plurality of bins including a number of sets of fields; and
7 search the at least one corresponding bin to identify a set of fields matching the
8 packet.

1 66. The article of manufacture of claim 65, wherein the content, when
2 accessed, further causes the machine to:
3 identify an action associated with the set of matching fields; and
4 apply the action to the packet.

1 67. The article of manufacture of claim 65, wherein the set of matching fields
2 includes a transport level field.

1 68. The article of manufacture of claim 65, wherein the content, when
2 accessed, further causes the machine, when determining the result, to identify a single
3 most specific filter matching the packet.

1 69. The article of manufacture of claim 68, wherein the network path of the
2 packet is expressed as a source address and a destination address.

1 70. The article of manufacture of claim 69, wherein the content, when
2 accessed, further causes the machine, when identifying the single most specific matching
3 filter, to:
4 perform a look-up in a first data structure to find an entry matching the source address of
5 the packet; and
6 perform a look-up in a second data structure to find an entry matching the destination
7 address of the packet.